

REMARKS/ARGUMENTS

CLAIMS REJECTION 35 USC §102(b)

On page two of the Office Action under the heading "Detailed Action", the Examiner rejects all of the pending claims in this matter under 35 USC §102(b) as being anticipated by Reynolds, *et al.* (4,988,433) on the ground that Reynolds discloses operating temperatures of about 260°F, a pH greater than 2, an acetate to calcium mole ratio of at least 2 to 1, and calcium removal rates in excess of 60%. Similar process conditions resulting in a calcium enriched aqueous mixture separated from the feed are also cited as anticipatory.

With respect, Applicants disagree that Reynolds is anticipatory and argue that Reynolds does not anticipate the surprisingly high calcium removal rates in excess of 90% when the pH of the extraction solution is limited to the substantially lower and narrower range of 3.5 to 4.6 as opposed to the significantly higher and broader pH range of 5 to 9 preferred by Reynolds. Moreover, Reynolds does not anticipate the high calcium extraction rates of the present invention, which result from the combination of the low and narrow pH range in combination with a relatively low acid to calcium mole ratio. More specifically, Reynolds discloses adjusting the pH of the extraction solution to above 2 but further discloses a preference for a pH range between 5 to 9 and most preferably the pH should be 6. Consistent with this preference, example 1 of the reference discloses an aqueous acetic acid extraction solution wherein the pH is adjusted to between 6 and 7 with ammonium hydroxide. The maximum calcium extraction rate achieved in this example is 83%, but only when the acid to calcium mole ratio was 30:1 (see example 1d in Table 1 at column 4, line 25).

In contrast to Reynolds, the instant invention is a significant improvement over the invention disclosed in Reynolds. Specifically, as shown in the examples, beginning on page 9 of the specification, calcium removal rates well in excess of 90% are achieved when the pH of an aqueous acetic acid extraction solution is adjusted with ammonium hydroxide to a relatively narrow range between about 3.5 and 4.6 in combination with an acetate ion to calcium ratio of 9:1 or lower. Table 1 presents calcium removal rates between 96.3% and 98.4% in a crude oil containing 230 ppm calcium (acid to calcium mole ratio is 4.5) when the pH is adjusted with ammonium hydroxide to between about

3.5 and 4.53. Similarly, example 4A, as presented in table 4 on page 13 of the Specification shows a nearly 100% calcium removal rate with an acetic acid extraction solution adjusted to a 4.44 pH with ammonium hydroxide and having an acetate ion to calcium ratio of 9:1. In short, Reynolds does not anticipate a method for removing calcium from crude oil, utilizing an aqueous acetic acid solution with a limited pH range between 3.5 and 4.6 wherein calcium removal rates exceed 90%.

Consistent with the above arguments, applicants have amended Claim 1 and related dependent claims to more specifically claim the pH range of the extraction solution to between 3.5 and 4.6 and the calcium extraction rate to be at least 90% of the calcium present in the hydrocarbonaceous material. Support for these amendments can be found in the Specification examples, specifically, Table 1; test numbers 1a 1b, 1d; Table 2, test number 2b; Table 4, test number 4a; and Table 5, test number 5b. The surprisingly high calcium removal rates achieved within the narrow pH range claimed is also depicted in Figure 1.

CLAIM REJECTIONS UNDER 35 USC §103

On page 3 of the Office Action, the Examiner rejects claims 6, 7, 12, 16, 19, and 20 under 35 USC §103(a) as being unpatentable over Reynolds *et al.* In particular, the Examiner rejects claims 6, 7, 19 and 20 on the ground that the claimed pH ranges of 3.5 and 4.7 or 3.5 and 4.6 would be obvious to one of ordinary skill in the art because Reynolds discloses a pH range in excess of 2. With respect, applicants disagree, and note that Reynolds teaches away from the lower and narrower pH ranges as claimed in the instant case. Specifically, at column 3, line 16 Reynolds discloses adjusting the pH of the extraction solution with ammonia or ammonium hydroxide to a pH above 2, and then states a preference for a significantly higher pH range between 5 and 9. More specifically, at the bottom of column 3, lines 56 through 61; Reynolds again states a preference for a pH of between 5 to 9 and most preferably a pH of 6. Similarly, in the examples, Reynolds discloses a pH between 6 and 7 for examples 1 and 2 and a pH as high as 7.5 in example 3. With these high pH levels, Reynolds did not achieve calcium rates in excess of 87% and with respect to any acetic acid based extraction solution, the highest removal rate was 83%, which could only be achieved in combination with an acid to calcium mole ratio of 30:1. Accordingly, it would not be obvious to one skilled in the art, in view of Reynolds, to limit the pH of the extraction solution to the narrow range

claimed in the instant application to achieve the significantly higher calcium removal rates achieved by the Applicants in this case.

As to the operating temperature range of 25°C to 110°C (77° to 230°F) claimed in Claim 12, Applicants respectfully disagree that the claimed operating condition is obvious and light of Reynolds. In the first instance, Reynolds does not disclose any particular operating conditions for extraction of calcium from crude oil other than specifying in example 1 and example 2 the particular operating temperature of 180°F. Furthermore, the operating condition of 250°F or above is in specific reference to a calcium removal operation carried out in concert with a crude desalting operation. What is not obvious to one of ordinary skill in the art of petroleum refining is performing calcium removal within the claimed operating temperature range in combination with an aqueous acetic acid extraction solution having a pH between about 3.5 to 4.6 and an acid to calcium mole ratio of about 4.5 to 1 to about 9 to 1.

Similarly, Claim 16 is not obvious in light Reynolds for the reason that Reynolds simply, broadly, and vaguely discloses “unacceptably high levels of calcium ... in feed stocks” and then reports a 54 ppm calcium concentration in the feed stock of example 1 and example 2, and calcium concentration of half that in example 3. Even at these low calcium concentration levels, Reynolds does not achieve nearly the calcium removal percentages achieved in the instant invention. Moreover the highest calcium removal rate achieved in Reynolds was achieved only when the mole ratio of acid to calcium was 30:1, a ratio more than 3 times higher than the highest mole ratio in the instant case.

As set forth in § 2141 of the MPEP, rejections under 35 USC §103 must follow certain basic legal tenants. These tenants are:

- a. the claimed invention must be considered as a whole;
- b. the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;
- c. the references must be viewed without the benefit in impermissible hind sight vision afforded by the claimed invention; and
- d. a reasonable expectation of success is the standard with which obviousness is determined.

In this light, and considering the invention as a whole, Reynolds does not contain any suggestion or motivation to limit the pH range of the extraction solution to the relatively narrow 3.5 to 4.6 range to achieve calcium removal rates in excess of 90%. In fact, Reynolds tends to teach away from such low and limited pH ranges in its stated

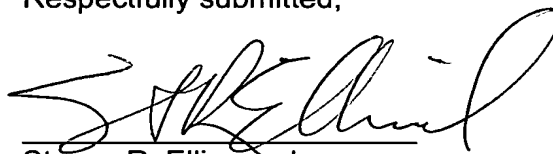
preference for a pH range of 5 to 9 and a most preferred pH of 6. Such "teaching away" is further bolstered in example 1 where the extraction solution pH is between 6 and 7, which achieves a calcium removal rate of only 83% when the acid to calcium mole ratio is 30:1.

Finally, it would not have been obvious to one of skill in the art to modify the Reynolds process by operating the process at a temperature between 20°C and 110°C or to use feeds containing greater than 100 ppm calcium because there is no teaching, suggestion or motivation to combine such operating parameters with the low and narrow pH ranges of the instant invention either in Reynolds or in the knowledge generally available to one skilled in the art. The present invention is not obvious in light of Reynolds.

CONCLUSION

It is respectfully submitted that in view of the above arguments, the amended claims as they now appear in the case are in proper form and are patentable over all the art of record. Therefore, Applicants earnestly solicit withdrawal of all rejections based on §§102 and 103 of the Patent Act and timely allowance of said amended claims.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "S. R. Ellinwood", written over a horizontal line.

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